

77 02069

**CITY OF LOMITA
SEISMIC SAFETY ELEMENT**

OF THE GENERAL PLAN

MAY 1974

**INSTITUTE OF GOVERNMENTAL
STUDIES LIBRARY**

MAY 5 1977

UNIVERSITY OF CALIFORNIA

*Lomita. City council.
City planning Lomita
Emerg. relief Earthquakes "*

**Prepared and Submitted by: Allen B. Stephenson
City Administrator and
Planning Director**

**Richard C. Anderson
Planning Advisor**

77 02069

INSTITUTE OF GOVERNMENTAL STUDIES LIBRARY
109 PHILOSOPHY HALL
UNIVERSITY OF CALIFORNIA
BERKELEY, CA 94720

RECEIVED
GOVERNMENTAL STUDIES LIBRARY

UNIVERSITY OF CALIFORNIA

MAY 1 1977

INSTITUTE OF GOVERNMENTAL
STUDIES LIBRARY

MAY 8 1977

UNIVERSITY OF CALIFORNIA

RECEIVED
GOVERNMENTAL STUDIES LIBRARY
UNIVERSITY OF CALIFORNIA
BERKELEY, CA 94720
MAY 1 1977

RESOLUTION NO. 74-44

A RESOLUTION OF THE CITY COUNCIL OF THE CITY
OF LOMITA ADOPTING THE SEISMIC SAFETY ELEMENT
OF THE GENERAL PLAN

WHEREAS, the City of Lomita adopted a General Plan on
December 12, 1966, by Resolution No. 66-59; and

WHEREAS, a Seismic Safety Element is required as a part of
said General Plan; and

WHEREAS, the Planning Commission has recommended that the
attached Seismic Safety Element be adopted after a public hearing
had been held thereon; and

WHEREAS, after public hearing the City Council is of the
opinion that such Seismic Safety Element be adopted;

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE
CITY OF LOMITA RESOLVES AS FOLLOWS:

SECTION 1. That the proposed Seismic Safety Element attached
hereto and incorporated herein by this reference, is hereby adopted
as part of the General Plan of the City of Lomita.

PASSED, APPROVED AND ADOPTED this 17th day of June, 1974.

Charles Belba

MAYOR

ATTEST:

Lawn R. Tomita

CITY CLERK

I HEREBY CERTIFY that the foregoing resolution was duly and
regularly approved at the City Council meeting held on the 17th day
of June, 1974, by the following roll call vote:

AYES:	COUNCILMEN:	Anderson, Cole, Hall, Moore and Mayor Belba
NOES:	COUNCILMEN:	None
ABSENT:	COUNCILMEN:	None

Lawn R. Tomita

CITY CLERK

TABLE OF CONTENTS

	<u>Page</u>
PREFACE	i
INTRODUCTION	
Authority for Seismic Safety Element	1
Background for the Element	2
OBJECTIVES AND POLICIES	
Goals and Objectives	5
General Policies	5
Emergency Operations for Earthquakes	7
GENERAL INFORMATION ON EARTHQUAKES	
Faults and Seismicity	9
Geological Processes of Earthquakes	10
Surface Faulting	11
Ground Shaking	12
Ground Failure	13
Results of Ground Failure	14
Tsunami and Seiche Effects	14
How Earthquakes are Measured	15
Richter Magnitude Scale	16
Modified Mercalli Intensity Scale of 1931	18
TECHNICAL FINDINGS OF THE SEISMIC SAFETY ELEMENT	
Natural Hazards - Faults and Seismicity	20
General Geology of Area	23
Structural Hazards and Critical Services	23
Edison Sub-Station	23
Oil Wells	24
Telephone Services	24
Water Systems in Lomita	25
Schools in Lomita	27
Churches in Lomita	28
Group Quarters in Lomita	30

LAND USE AND CIRCULATION

Land Use	31
Circulation Patterns	32

SEISMIC SAFETY ELEMENT RELATIONSHIPS

Relationship to the General Plan	34
Geographical and Physical Relationships	34
Social Relationships	36
Economic Relationships	37
Environmental Impact Report Procedures	37
Interagency Cooperation	38

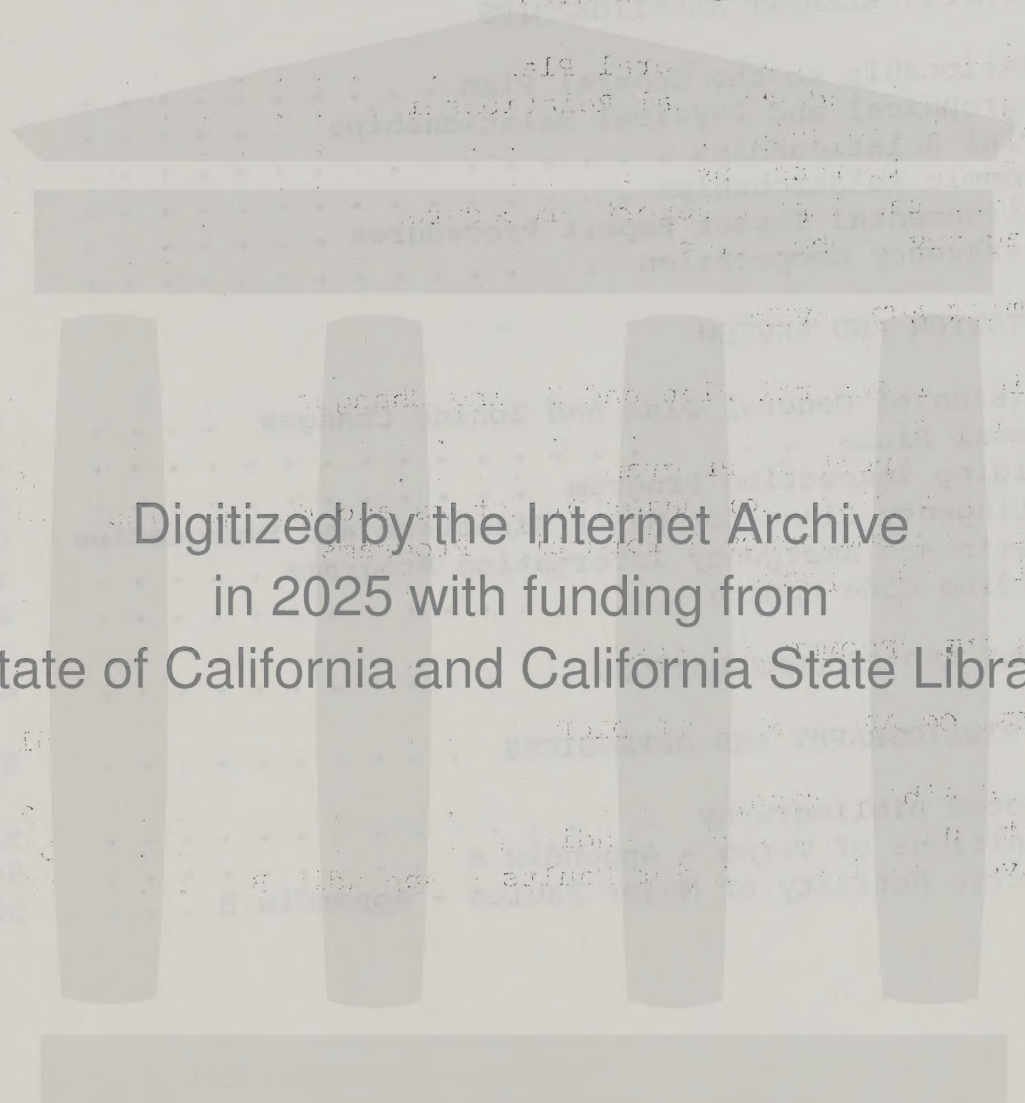
IMPLEMENTATION AND REVIEW

Revision of General Plan and Zoning Changes	39
Renewal Plans	40
Building Inspection Program	40
Contingency Plans for Major Disasters and Emergencies	41
Seismic and Emergency Information Programs	42
Building Code Update	43

CONCLUSIONS AND RECOMMENDATIONS 44

SELECTED BIBLIOGRAPHY AND APPENDICES 51

Selected Bibliography	52
Definitions of Terms - Appendix A	54
Relative Activity of Major Faults - Appendix B	58



Digitized by the Internet Archive
in 2025 with funding from
State of California and California State Library

<https://archive.org/details/C123320293>

PREFACE

Shortly after six o'clock on the morning of February 9, 1971, between five and ten million residents of Southern California were awakened by the sudden and frightening shock of an earthquake. In ten seconds extensive damage was done to structures, mainly in the northern San Fernando Valley. Some of these structures collapsed, causing deaths and injuries, others were damaged to the verge of collapse, and many suffered costly, though non-hazardous, damage.

The earthquake centered near Pacoima Dam just northeast of the San Fernando Veterans Administration Hospital. In the northern San Fernando Valley the shaking was very intense; in central Los Angeles the shaking was strong, attenuating to rather weak shaking in Long Beach. It was fortunate that the earthquake was not of greater magnitude, for in that case a much greater area would have experienced very strong ground shaking and there would have been a much greater loss in life and property damage.

The earthquake had a Richter magnitude of 6.6, and the area deformed by the fault slip was about twelve to fifteen miles on a side. The effect was that an area of approximately 200 square miles in the San Gabriel Mountains moved southward and rose permanently several feet. In doing so it caused very strong ground shaking over this area and propagated ground-shaking waves, whose intensity decreased with distance, over a substantially larger area.

Fortunately, the San Fernando earthquake was not a great shock in geological terms. It released only one hundredth as much energy as the 1964 Alaska earthquake. In fact, shocks of energy-release comparable to the San Fernando earthquake occur about once every five years in Southern California, but they are seldom close to developed areas. The San Fernando earthquake caused a greater financial loss than the much larger Alaska earthquake because it occurred on the edge of a large metropolitan area instead of in a sparsely populated region.

Still, it was mainly good fortune that the fatalities were relatively few. Had the earthquake centered twenty miles farther south, close to the center of population in metropolitan Los Angeles, it would have done much more damage and caused the collapse of many more old buildings. Had it occurred three hours later in the day there would have been many more occupants in the buildings that did collapse. Had the freeways been crowded, the bridges that collapsed would have caused many more deaths and injuries, and other casualties would have resulted from automobile accidents caused by the sudden disruption of the thoroughfare. Had the earthquake occurred when more people were on downtown streets there would have been many more casualties from falling debris. Finally, the lower San Fernando Dam had only four feet of freeboard after its partial failure; had it then failed completely - or even after emptying was well along - an area inhabited by 80,000 people would have been inundated.

There is reasonable expectation that before the end of the century an earthquake of much greater magnitude will occur in Southern California. It can be expected to produce very strong shaking over the entire Los Angeles metropolitan area. This ground shaking probably will not exceed the intensity experienced in northern San Fernando Valley, but it may be almost as strong.

Most modern construction withstood strong ground shaking satisfactorily during the San Fernando earthquake, which shows that the metropolitan area can be made to survive a truly great earthquake if certain necessary improvements are made.

The earthquake did reveal certain weaknesses in engineering and construction practices, and in institutional and organizational arrangements. The Commission believes that these weaknesses can be corrected by appropriate improvements in safety regulations, in building codes and in preparations for an emergency. Even though the earthquake brought tragedy to some, if it leads to the correction of these weaknesses it will have brought a long-term benefit to all Southern Californians.

-- Report of the Los Angeles County
Earthquake Commission
SAN FERNANDO EARTHQUAKE
February 9, 1971

SEISMIC SAFETY ELEMENT

CITY OF LOMITA

INTRODUCTION

Authority for Seismic Safety Element

Section 65302(f) of the Government Code of the State of California requires that each city prepare and adopt a seismic safety element of the city's general plan as follows:

A seismic safety element consisting of an identification and appraisal of seismic hazards such as susceptibility to surface ruptures from faulting, to ground shaking, to ground failures, or to effects of seismically induced waves such as tsunamis and seiches.

The seismic safety element shall also include an appraisal of mudslides, landslides, and slope stability as necessary geologic hazards that must be considered simultaneously with other hazards such as possible surface ruptures from faulting, ground shaking, ground failure and seismically induced waves.

In accordance with that section of the Government Code, the City of Lomita has prepared a seismic safety element which takes into consideration the specific geological and physical characteristics of Lomita, as well as the general characteristics from a seismological standpoint of the geographical area in which the city is located.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

WATER RESOURCES DIVISION
WASHINGTON, D. C.

REPORT
NO. 1

WATER RESOURCES DIVISION
WASHINGTON, D. C.

Section 101 (a) of the Federal Water Control Act of 1917, as amended, provides that the Secretary of Agriculture shall, in cooperation with the Secretary of War, conduct a study of the water resources of the United States, and shall report thereon to the President.

The study of the water resources of the United States is a task of great importance, and one which requires the cooperation of all interested agencies. The Department of Agriculture, through the Forest Service, is particularly interested in the water resources of the Nation, and is conducting a study of the same.

The study of the water resources of the United States is a task of great importance, and one which requires the cooperation of all interested agencies. The Department of Agriculture, through the Forest Service, is particularly interested in the water resources of the Nation, and is conducting a study of the same.

The study of the water resources of the United States is a task of great importance, and one which requires the cooperation of all interested agencies. The Department of Agriculture, through the Forest Service, is particularly interested in the water resources of the Nation, and is conducting a study of the same.

Background For The Element

The Urban Geology Master Plan prepared by the California Division of Mines and Geology in 1973 states that, if given a continuation of present conditions, it is estimated that losses due to earthquake shaking will total \$21 billion in California between 1970 and the year 2000. That report also states that losses, especially life losses, due to shaking from future earthquakes can and should be reduced through a combination of measures involving geologic and seismicologic research, engineering practices, building codes, urban planning and zoning, fiscal and taxation policies, and preparedness planning. Estimates of potential loss of life for this period range well up into the thousands.

The General Plan Guidelines of the California Council on Intergovernmental Relations issued in September 1973 points out the following information about earthquakes:

The most widespread effect of an earthquake is ground shaking. This is usually (but not always) the greatest cause of damage. Structures of all types, including engineered structures and public utility facilities, if inadequately constructed or designed to withstand the shaking force, may suffer severe damage or collapse. The vast majority of deaths during earthquakes are the result of structural failure due to ground shaking. Most such deaths are preventable, even with present knowledge. New construction can and should be designed and built to withstand probable shaking without collapse. The greatest existing hazard in the State is the continued use of tens of thousands of older structures incapable of withstanding earthquake forces. Knowledge of earthquake-resistant design and construction has increased greatly in recent years, though much remains to be learned.

The Department of Defense has been advised that the following information is being furnished to you for your information.

On 10/10/68, the Department of Defense received information from the Central Intelligence Agency regarding the activities of the following individuals:

1. [Name], [Address], [City], [State], [Zip]

2. [Name], [Address], [City], [State], [Zip]

3. [Name], [Address], [City], [State], [Zip]

4. [Name], [Address], [City], [State], [Zip]

5. [Name], [Address], [City], [State], [Zip]

6. [Name], [Address], [City], [State], [Zip]

7. [Name], [Address], [City], [State], [Zip]

8. [Name], [Address], [City], [State], [Zip]

9. [Name], [Address], [City], [State], [Zip]

10. [Name], [Address], [City], [State], [Zip]

11. [Name], [Address], [City], [State], [Zip]

12. [Name], [Address], [City], [State], [Zip]

13. [Name], [Address], [City], [State], [Zip]

14. [Name], [Address], [City], [State], [Zip]

15. [Name], [Address], [City], [State], [Zip]

16. [Name], [Address], [City], [State], [Zip]

17. [Name], [Address], [City], [State], [Zip]

18. [Name], [Address], [City], [State], [Zip]

19. [Name], [Address], [City], [State], [Zip]

20. [Name], [Address], [City], [State], [Zip]

21. [Name], [Address], [City], [State], [Zip]

22. [Name], [Address], [City], [State], [Zip]

23. [Name], [Address], [City], [State], [Zip]

24. [Name], [Address], [City], [State], [Zip]

A second effect of earthquakes is ground failure in the form of landslides, rock falls, subsidence and other surface and near-surface ground movements. This is often the result of complete loss of strength of water-saturated sub-surface foundation soils ("Liquefaction"), such as occurred near the Juvenile Hall in the 1971 San Fernando earthquake, and in the massive Turnagain Arm landslide in Anchorage, during the 1964 Alaska earthquake. Most such hazardous sites can be either avoided or stabilized if adequate geologic and soil investigations are utilized.

Another damaging effect of earthquakes is ground displacement (surface rupture) along faults. Such displacement of the earth's crust may be vertical, horizontal or both and may offset the ground by as much as 30 feet (as in 1857 in Southern California). It is not economically feasible to design and build foundations of structures (dams, buildings, bridges, etc.) to remain intact across such zones. Fault zones subject to displacement are best avoided in construction. In addition to regional investigations necessary to the basic understanding of faults and their histories, detailed site investigations are needed prior to the approval of construction in any suspected active fault zone. Utilities, roads, canals and other linear features are particularly vulnerable to damage as the result of ground displacement.

Other damaging effects of earthquakes include tsunamis (seismic sea waves, often called "tidal waves"), such as the one which struck Crescent City and other coastal areas in 1964; and seiches (waves in lakes and reservoirs due to tilting or displacement of the bottom or margin). The failure of dams due to shaking, fault displacement or overtopping (from seiches or massive landsliding into the reservoir) can be particularly disastrous. Most modern dams are designed and constructed to be earthquake-resistant; some older dams were not. In addition to man-made dams, temporary dams may be created by earthquake-triggered landslides. Such inadvertently created dams are certain to fail within a relatively short time.

Injury, loss of life, and property damage resulting from earthquakes are not only caused by structural deficiencies but also by equipment, machinery, furniture, and other installations which happen to be located within a structure.

It should be recognized that the building of structures in this area involves an element of risk and that future construction must be in accordance with that risk. Consequently, Lomita's policies should be geared to the following definitions:

Acceptable Risk - The level of risk below which no specific action by local government is deemed to be necessary.

Unacceptable Risk - Level of risk above which specific action by government is deemed to be necessary to protect life and property.

Avoidable Risk - Risk not necessary to take because individual or public goals can be achieved at the same or less total "cost" by other means without taking the risk.

OBJECTIVES AND POLICIES

Goals and Objectives

The seismic safety goals and objectives of the City of Lomita are to develop and implement programs that will help to protect the lives and property of city residents by reducing seismic hazards.

The potential dangers created by seismic activity requires that it should be the basic goal of the City to:

1. Minimize injuries and the possible loss of life, disruption of public services, and damage to or destruction of property associated with major earthquakes.
2. Aid in the restoring of services to a level that enables the residents and businesses to return to normal activity as soon as possible after an earthquake.
3. Reduce the economic and social dislocations resulting from a major seismic event.

General Policies

In carrying out Lomita's policies and reaching the objectives for seismic safety it will be necessary for the City to:

1. Provide a base of seismic information that will require consideration of geologic hazards at the earliest possible point in the further development of the city.

2. Support a realistic disaster plan which would quickly become operational should the area be affected by a major earthquake or other type of disaster.
3. Minimize the number of existing structures and conditions that represent seismic hazards through enforcement of building codes.
4. Require geologic reports as a pre-requisite to the issuance of building permits for major structures.
5. Use geologic and seismic data to guide the placement and development of essential public structures such as schools, police and fire facilities, hospitals, and other types of critical installations.
6. Require consideration of geologic and seismic data in the preparation of environmental impact reports.
7. Inform the public of potential seismic hazards as they affect buildings and structures.

From the standpoint of man-made structures, exposure to earthquake hazards involves several factors:

1. Seismic nature of the site on which a structure is located.
2. Ability of a structure to resist earthquakes.
3. Use or occupancy of a structure, both as to number of occupants and amount of time occupied.

4. Effective life of a structure from a physical standpoint.

Emergency Operations for Earthquakes

After the San Fernando Earthquake of 1971, various governmental agencies the American Red Cross, and non-governmental groups took effective measures to minimize the disastrous effects of the earthquake. Recovery was relatively rapid. However, weaknesses were noted in emergency operations. Some agencies performed independently at a time when team effort would have been of greater benefit. The need was shown for local agencies to provide emergency operating centers where information could be pooled and coordination achieved from a single, central location. Since disasters usually affect many local governments, provision should be made for interjurisdictional coordination and exchange of information in the event of an emergency.

Providing for seismic safety includes the development of a major earthquake response plan. Such a plan should:

1. Outline actions to be taken in earthquake situations.
2. Be coordinated with emergency plans of other governmental organizations - both local and county-wide.
3. Contain descriptive elements based upon local conditions such as:

- a. Organization and training
- b. Communications control
- c. Fire protection
- d. Water and other utility systems
- e. Medical and hospital services
- f. Transportation (if necessary)

The emergency plan should provide an organizational structure for dealing with any type of local emergency. It is a tool for use in case of a major earthquake, but it must be geared to function in any disaster. In preparing the EOP, the following response priorities should be considered:

1. Provide medical aid to the injured, protect the uninjured from hazards created by the earthquake, and provide for those people who are left homeless.
2. Restore community services as soon as possible, including utility services and the reopening of essential businesses.
3. Protect public and private property from further damage due to aftershocks, fire and looting.
4. Provide services to neighboring communities that also have been damaged and need assistance.
5. Facilitate post-disaster recovery throughout the community.

GENERAL INFORMATION ON EARTHQUAKES

Faults and Seismicity

Seismic movements of the earth or earthquakes are caused by the sudden rupturing of the earth along faults (weak portions of the earth's crust). Apparently, this rupturing relieves stress that has been building up in the earth's crust. It also is generally believed that this stress is caused by the movement of plates in the earth's crust. As these crustal plates move against or past one another, stress develops which causes the crust on the edge of each plate to become deformed. When too much deformation builds up, the rocks snap along a fault. This relieves the strain by allowing each side of the fault to move to a position of lower stress.

A fault which separates two plates is not always perceivable on the earth's surface, but there are land forms and geologic criteria and instrumentation which can be used to map its location. The fault is not one solid, continuous line, but is composed of a system of splinter faults which appear periodically on the earth's surface. The term fault trace is used to describe a line on the surface of the earth formed by the intersection of the fault with the earth's surface.

Rupture and cracking of the ground are surface expressions of earthquakes which originate on subsurface faults. Earthquakes occur at various depths within the earth's crust. The point below the surface where the rupture first occurs is known as the focus and can be located with the help of seismic instruments. The term "epicenter" is usually used to describe the point of initial rupture. The instrumental epicenter is that point on the earth's surface directly above the focus but may not be the area of maximum damage.

There are two kinds of faults: active faults which have experienced displacement in recent geologic time, suggesting that future displacement can be expected on these faults; and inactive faults that have shown no evidence of movement in recent geologic time, suggesting that these faults are dormant. However, some faults labeled as inactive are so termed due to lack of knowledge.

Geological Processes of Earthquakes

Earthquakes commonly give rise to various geological processes that may cause severe damage to structures and loss of life to people in them. These processes include surface faulting, ground shaking, associated ground failure, generation of large waves in bodies of water, and regional subsidence. These seismic hazards vary widely from area to area, and the level of these hazards depends on both geologic conditions and the extent and type of land use. They are described below:

rupture and cracking as the expansion of the
pushes which originate at the base of the
various depths within the earth. The points below the surface
where the rupture takes place are known as the focus and can be located
with the help of seismological measurements. The "epicenter" is usually
used to describe the point of initial rupture. The measurement of the
distance is by determining the earth's surface topography above the focus
but may not be the same as the distance between the focus and the surface.

There are two kinds of seismic waves which have been distinguished
displacement in the direction of travel. These are the P waves and the S waves.
The P waves are longitudinal waves and the S waves are transverse waves.
The P waves are the first to be recorded on a seismograph and are the most
abundant. They are also the most penetrating and can travel through the
solid earth. The S waves are the second to be recorded and are less
abundant. They cannot travel through the liquid outer core of the earth.
The surface waves are the third to be recorded and are the most destructive.
They are the result of the interaction of the P and S waves at the surface.
The surface waves are the most common and are the most destructive.

The seismic waves are classified into three groups: body waves, surface waves, and
longitudinal waves. The body waves are the P waves and the S waves. The
surface waves are the Love waves and the Rayleigh waves. The longitudinal
waves are the P waves. The seismic waves are the result of the rupture of
the earth's crust. The seismic waves are the most common and are the most
destructive. The seismic waves are the result of the rupture of the earth's
crust. The seismic waves are the most common and are the most destructive.
The seismic waves are the result of the rupture of the earth's crust. The
seismic waves are the most common and are the most destructive. The seismic
waves are the result of the rupture of the earth's crust. The seismic waves
are the most common and are the most destructive. The seismic waves are the
result of the rupture of the earth's crust. The seismic waves are the most
common and are the most destructive. The seismic waves are the result of the
rupture of the earth's crust. The seismic waves are the most common and are
the most destructive. The seismic waves are the result of the rupture of the
earth's crust. The seismic waves are the most common and are the most
destructive. The seismic waves are the result of the rupture of the earth's
crust. The seismic waves are the most common and are the most destructive.

Surface Faulting. The earth's crust is laced with faults - -

planes or surfaces in earth materials along which failure has occurred and materials on opposite sides have moved relative to one another in response to the accumulation of stress. Most of these faults have not moved for thousands of years and thus can be considered inactive. Others, however, show evidence of current activity or have moved sufficiently recently to be considered active, i.e., capable of displacement in the near future. A fault movement beneath a building in excess of an inch or two could have catastrophic effects on the structure, depending upon its design and construction and the shaking stresses it experiences at the same time.

Generally, faults are regarded as active and of concern to land-use planning when there is evidence that they have moved during historic time; or through geologic evidence, there may be a significant likelihood that they will move during the projected use of a particular structure or piece of land. Because geologic evidence may be lacking as to the times of past movement, geologists may be able to estimate relative degree of activity only after a regional analysis that may extend far beyond the locality under consideration. Such analysis may be based on historic evidence of fault movement, seismic activity (occurrence of small to moderate earthquakes along the fault trace even though not accompanied by obvious fault movement), displacement of

recent earth layers (those deposited during the past 10,000 years), and presence of topographical fault-produced features (scarps, sag ponds, offset stream courses and disruption of man-made features such as fences and curbs.)

Movement seldom is limited to a single fault surface throughout the lifetime of a fault system such as the San Andreas. In many places individual fault surfaces make up the San Andreas in a zone varying in width from a few hundreds to thousands of feet. Faults that commonly produce significant displacement (more than several inches at a time) often have related branches that diverge from the main fault but usually have less movement along them. They also may have secondary faults that are not directly or obviously connected physically to the main fault trace. Secondary faults are usually nearby (within hundreds of feet) of the main rupture, but they may extend as much as several miles away. As with branch faults, displacement along secondary faults is usually only a fraction of that along a main fault.

Ground Shaking. Probably the most difficult task today, in terms of the predictive capability of the geologist and seismologist, is devising a reasonably reliable method of predicting "ground shaking" effects - - what most people and structures react to during an earthquake. Examination of damage from numerous past earthquakes, in lieu of conclusive strong-motion seismograph records, has suggested to

geologists and engineers that the greatest damage to tall structures results where they are built over thick, relatively soft, water-saturated sediments and that the least damage occurs where they are built on very firm bedrock.

Ground Failure. Earth materials in a natural condition tend to reach equilibrium over a long period of time. In geologically active areas such as California and Alaska, there are many regions where earth materials have not yet reached a natural state of stability. For example, most of the valleys and bay margins are underlain by recent loose materials that have not been compacted and hardened by long-term natural processes. Landslides are common on most of the hills and mountains as loose material moves downslope. In addition, many activities of man tend to make the earth materials less stable and hence to increase the chance of ground failure. Some of the natural causes of instability are earthquakes, weak materials, stream and coastal erosion, and heavy rainfall. Human activities that contribute to instability include oversteepening of slopes by undercutting them or overloading them with artificial fill, extensive irrigation, poor drainage, groundwater or oil withdrawal, and removal of stabilizing vegetation. These causes of failure, which normally produce landslides and differential settlement, are augmented during earthquakes by strong ground motions that result in rapid changes in the state of earth materials. It is these changes, by means of liquefaction and loss of

strength in fine-grained materials, that result in so many landslides during earthquakes.

Results of Ground Failure. Although the basic causes of ground instability are simple in concept, the consequences are often complex and highly variable. They include numerous varieties of landslides, ground cracking, lurching, subsidence, and differential settlement. Moreover, these types of ground failure occur on a wide variety of ground conditions. Landslides, for example, do not necessarily require a steep slope on which to form, particularly during earthquakes. Many occur on slopes that are virtually flat, and the surface on which they fail may be very shallow (1 to 2 feet deep) or as much as hundreds of feet below the ground surface. The type of ground failure that develops in a given area is determined by the nature of the natural or man-made disturbance that occurs and partly by the topographic, geologic, hydrologic, and geotechnical characteristics of the ground.

Tsunami and Seiche Effects. Tsunamis are large ocean waves which are generated by rapid changes in elevation of large masses of earth and water. Such rapid movement may generate huge waves of destructive force that can travel thousands of miles. During the 1964 Alaskan earthquake, for example, faulting and crustal warping created tsunamis, or sea waves, tens of feet high that spread more than 1,500 miles from the source area and caused devastation to coastal communities within

their reach. The effects of tsunamis can be greatly amplified by the configuration of the local shoreline and the sea bottom. Seiches are earthquake-generated waves within enclosed or restricted bodies of water (lakes, reservoirs, and bays).

How Earthquakes Are Measured

Vibrations produced by earthquakes are detected, recorded, and measured by instruments called seismographs. The zig-zag trace recorded by a seismograph - called a "seismogram" - reflects the varying amplitude of the vibrations by responding to the motion of the ground beneath the instrument. From the data expressed in seismograms, the time, epicenter, and focal depth of an earthquake can be determined, and estimates can be made of the amount of energy that was released.

The severity of an earthquake can be expressed in several ways. The magnitude of an earthquake, as expressed by the Richter magnitude scale, is a measure of the amplitude of the seismic waves. The amplitude is measured on seismograph recordings. When the earthquake occurs, the amplitude of the wave recorded on the seismograph is measured and then is corrected mathematically to what the amplitude would have been if it had been recorded at a distance of 100 kilometers from the epicenter. The Richter magnitude derived from these corrected seismograph recordings indicates the amount of energy released as if it had been recorded at this standard 100-kilometer distance from the epicenter of the quake.

The intensity as expressed by the Modified Mercalli Intensity Scale, is a partly subjective measure which depends on the effects of a quake such as damage at a particular location.

Richter Magnitude Scale. The Richter magnitude scale, named after Dr. Charles F. Richter, Professor Emeritus of the California Institute of Technology, measures the energy of an earthquake at its source, and is the scale most commonly used. On this scale, the earthquake's magnitude is expressed in whole numbers and decimals. However, Richter magnitudes can be confusing and misleading unless the mathematical basis for the scale is understood. It is important to recognize that magnitude varies logarithmically with the wave amplitude of the quake recorded by the seismograph. Each whole number step of magnitude on the scale represents an increase of 10 times in the measured wave amplitude of an earthquake, and an increase of 31 times in the amount of energy released by the quake. Thus, the amplitude of an 8.3 magnitude earthquake is not twice as large as a shock of magnitude 4.3, but 10,000 times as large. Correspondingly, a magnitude 8.3 earthquake releases almost one million times more energy than one of magnitude 4.3.

A quake of magnitude 2 on the Richter scale is the smallest quake normally felt by humans. Earthquakes with a Richter magnitude of 7 or more are commonly considered to be major. The Richter magnitude scale

has no fixed maximum or minimum; observations have placed the largest recorded earthquake in the world at about 8.9, and the smallest at about -3. Earthquakes with magnitudes smaller than 2 are called "micro-earthquakes." Richter magnitudes are not used to estimate damage. An earthquake in a densely populated area, which results in many deaths and considerable damage, may have the same magnitude as an earthquake that occurs in a barren, remote area, that may do nothing more than frighten the wildlife.

Modified Mercalli Intensity Scale of 1931 - The first scale to reflect earthquake intensities was developed by de Rossi of Italy and Forel of Switzerland in the 1880's. This scale, with values from I to X, was used for about two decades. A need for a more refined scale increased with the advancement of the science of seismology, and in 1902, the Italian seismologist, Mercalli, devised a new scale on a I to XII range. The Mercalli Scale was modified in 1931 by American seismologists Harry O. Wood and Frank Neumann to take into account modern structural features, and modified by Charles F. Richter in 1956 and rearranged:

- I. Earthquake shaking not felt. But people may observe marginal effects of large distance earthquakes without identifying these effects as earthquake-caused. Among them: trees, structures, liquids, bodies of water sway slowly, or doors swing slowly.
- II. Shaking felt by those at rest, especially if they are indoors, and by those on upper floors.
- III. Felt by most people indoors. Some can estimate duration of shaking. But many may not recognize shaking of building as caused by an earthquake; the shaking is like that caused by the passing of light trucks.
- IV. Hanging objects swing. Windows or doors rattle. Wooden walls and frames creak.
- V. Felt by everyone indoors. Many estimate duration of shaking. But they still may not recognize it as caused by an earthquake. The shaking is like that caused by the passing of heavy trucks, though sometimes, instead, people may feel the sensation of a jolt, as if a heavy ball had struck the walls. Hanging objects swing. Standing autos rock. Crockery clashes, dishes rattle or glasses clink. Doors close, open or swing. Windows rattle.
- VI. Felt by everyone indoors and by most people outdoors. Many now estimate not only the duration of shaking but also its direction and have no doubt as to its cause. Sleepers wakened. Hanging objects swing. Shutters or pictures move. Pendulum clocks stop, start or change rate. Standing autos rock. Crockery clashes, dishes rattle or glasses clink. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Weak plaster and Masonry D* crack. Windows break. Doors close, open or swing.
- VII. Felt by everyone. Many are frightened and run outdoors. People walk unsteadily. Small church or school bells ring. Pictures thrown off walls, knickknacks and books off shelves. Dishes or glasses broken. Furniture moved or overturned. Trees, bushes shaken visibly, or heard to rustle. Masonry D* damaged; some cracks in Masonry C*. Weak chimneys break at roof line. Plaster, loose bricks, stones, tiles, cornices, unbraced parapets and architectural ornaments fall. Concrete irrigation ditches damaged.

Modified Mercalli Intensity Scale of 1931 (Continued)

- VIII. Difficult to stand. Shaking noticed by auto drivers. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Furniture broken. Hanging objects quiver. Masonry D* heavily damaged; Masonry C* damaged, partially collapses in some cases; some damage to Masonry B*, none to Masonry A*. Stucco and some masonry walls fall. Chimneys, factory stacks, monuments, towers, elevated tanks twist or fall. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off.
- IX. General fright. People thrown to ground. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes. Steering of autos affected. Branches broken from trees. Masonry D* destroyed; Masonry C* heavily damaged, sometimes with complete collapse; Masonry B* is seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames racked. Reservoirs seriously damaged. Underground pipes broken.
- X. General panic. Conspicuous cracks in ground. In areas of soft ground, sand is ejected through holes and piles up into a small crater, and, in muddy areas, water fountains are formed. Most masonry and frame structures destroyed along with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes and embankments. Railroads bent slightly.
- XI. General panic. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. General destruction of buildings. Underground pipelines completely out of service. Railroads bent greatly.
- XII. General panic. Conspicuous cracks in ground. In areas of soft ground, sand is ejected through holes and piles up into a small crater, and, in muddy areas, water fountains are formed. Damage nearly total, the ultimate catastrophe. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air.

- *Masonry A: Good workmanship and mortar, reinforced, designed to resist lateral forces.
Masonry B: Good workmanship and mortar, reinforced.
Masonry C: Good workmanship and mortar, unreinforced.
Masonry D: Poor workmanship and mortar and weak materials, like adobe.

Source: Urban Geology Master Plan

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

REPORT OF THE
SURVEY OF THE
LANDS OF THE
BUREAU OF LAND MANAGEMENT
IN THE
STATE OF
NEW YORK
BY
J. H. MANNING
AND
J. H. MANNING
JUNIOR
1911

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D. C.
1911

TECHNICAL FINDINGS OF THE SEISMIC SAFETY ELEMENT

Natural Hazards - Faults and Seismicity

The Geologic Map of California (Long Beach Sheet) prepared and published by the Division of Mines and Geology of the State Department of Conservation shows that there are four fault zones or faults in the general geographic area in which the City of Lomita is located. These zones or faults are identified as follows:

Newport-Inglewood Fault Zone which runs from the Culver City-Baldwin Hills area north of the City of Inglewood southeasterly through the cities of Compton, Long Beach, Signal Hill, Seal Beach, Huntington Beach and Newport Beach. This zone includes the Inglewood Fault, the Potrero Fault, the Avalon-Compton Fault, the Cherry Hill Fault, and the Seal Beach Fault.

Charnock Fault which runs from the Culver City area past the easterly side of the Los Angeles International Airport to the communities of Lennox and Hawthorne.

Palos Verdes Fault Zone which runs southeasterly along the northerly base of the Palos Verdes Hills from Redondo Beach to the San Pedro Harbor. This fault zone

Geological Survey of California

George B. Smith (Chief) prepared and published

the geological map of California under the State Department of

the Division of Mines and Geology, under the direction of

George B. Smith, Chief of the Division of Mines and Geology

under the direction of George B. Smith, Chief of the Division of

Mines and Geology, under the direction of George B. Smith, Chief

of the Division of Mines and Geology, under the direction of

George B. Smith, Chief of the Division of Mines and Geology

under the direction of George B. Smith, Chief of the Division of

Mines and Geology, under the direction of George B. Smith, Chief

of the Division of Mines and Geology, under the direction of

George B. Smith, Chief of the Division of Mines and Geology

under the direction of George B. Smith, Chief of the Division of

Mines and Geology, under the direction of George B. Smith, Chief

of the Division of Mines and Geology, under the direction of

George B. Smith, Chief of the Division of Mines and Geology

under the direction of George B. Smith, Chief of the Division of

Mines and Geology, under the direction of George B. Smith, Chief

of the Division of Mines and Geology, under the direction of

George B. Smith, Chief of the Division of Mines and Geology

under the direction of George B. Smith, Chief of the Division of

Mines and Geology, under the direction of George B. Smith, Chief

of the Division of Mines and Geology, under the direction of

George B. Smith, Chief of the Division of Mines and Geology

apparently runs through or near the southerly portion of the City of Lomita.

Cabrillo Fault which runs southeasterly from the Palos Verdes Hills and extends into the waters of the outer Los Angeles Harbor.

In addition to the above-mentioned fault zones or faults, the City of Lomita can be affected seismically by Southern California's two major fault systems - the San Andreas and the Transverse Ranges. The faults within the San Andreas system capable of adversely affecting Lomita are the San Andreas, San Jacinto, Whittier-Elsinore, Norwalk, and Newport-Inglewood (including the Palos Verdes). Faults of concern in the Transverse Ranges system include the Sierra Madre, San Fernando, Santa Susana and the Raymond. The major faults associated with both systems should be considered active and capable of generating independent seismic events.

Of the faults listed above, the Newport-Inglewood zone and the Palos Verdes fault have potentially the most adverse relations. The Newport-Inglewood zone is known to be seismically active, and it is located

about 6.5 miles northeast of Lomita. The Palos Verdes fault is not known to be seismically active and exhibits no evidence of ground breaks or of having offset Holocene (recent) deposits. It must be within the San Andreas system capable of adversely affecting Lomita are the San Andreas, San Jacinto, Whittier-Elsinore, Norwalk, and Newport-Inglewood (including the Palos Verdes). Faults of concern is the

Transverse Ranges system include the Sierra Madre, San Fernando, Santa Susana and the Raymond. The major faults associated with both systems should be considered active and capable of generating independent seismic events of the City of Lomita.

The Newport-Inglewood zone and the Palos Verdes Hills and extends into the waters of the outer Los Angeles Harbor. The Newport-Inglewood zone is known to be seismically active, and it is located about 5.5 miles northeast of Lomita. The Palos Verdes fault is not in addition to the above-mentioned fault zones of Lomita, the City of Lomita can be affected seismically by southern California's two major faults or of having offset Holocene (recent) deposits. It must be within the San Andreas system capable of adversely affecting Lomita are the San Andreas, San Jacinto, Whittier-Elsinore, Norwalk, and Newport-Inglewood (including the Palos Verdes). Faults of concern in the Transverse Ranges system include the Sierra Madre, San Fernando, Santa Susana and the Raymond. The major faults associated with both systems should be considered active and capable of generating independent seismic events of the City of Lomita.

The Palos Verdes fault is not in addition to the above-mentioned fault zones of Lomita, the City of Lomita can be affected seismically by southern California's two major faults or of having offset Holocene (recent) deposits. It must be within the San Andreas system capable of adversely affecting Lomita are the San Andreas, San Jacinto, Whittier-Elsinore, Norwalk, and Newport-Inglewood (including the Palos Verdes). Faults of concern in the Transverse Ranges system include the Sierra Madre, San Fernando, Santa Susana and the Raymond. The major faults associated with both systems should be considered active and capable of generating independent seismic events of the City of Lomita.

The Palos Verdes fault is not in addition to the above-mentioned fault zones of Lomita, the City of Lomita can be affected seismically by southern California's two major faults or of having offset Holocene (recent) deposits. It must be within the San Andreas system capable of adversely affecting Lomita are the San Andreas, San Jacinto, Whittier-Elsinore, Norwalk, and Newport-Inglewood (including the Palos Verdes). Faults of concern in the Transverse Ranges system include the Sierra Madre, San Fernando, Santa Susana and the Raymond. The major faults associated with both systems should be considered active and capable of generating independent seismic events of the City of Lomita.

The Palos Verdes fault is not in addition to the above-mentioned fault zones of Lomita, the City of Lomita can be affected seismically by southern California's two major faults or of having offset Holocene (recent) deposits. It must be within the San Andreas system capable of adversely affecting Lomita are the San Andreas, San Jacinto, Whittier-Elsinore, Norwalk, and Newport-Inglewood (including the Palos Verdes). Faults of concern in the Transverse Ranges system include the Sierra Madre, San Fernando, Santa Susana and the Raymond. The major faults associated with both systems should be considered active and capable of generating independent seismic events of the City of Lomita.

The Palos Verdes fault is not in addition to the above-mentioned fault zones of Lomita, the City of Lomita can be affected seismically by southern California's two major faults or of having offset Holocene (recent) deposits. It must be within the San Andreas system capable of adversely affecting Lomita are the San Andreas, San Jacinto, Whittier-Elsinore, Norwalk, and Newport-Inglewood (including the Palos Verdes). Faults of concern in the Transverse Ranges system include the Sierra Madre, San Fernando, Santa Susana and the Raymond. The major faults associated with both systems should be considered active and capable of generating independent seismic events of the City of Lomita.

The Palos Verdes fault is not in addition to the above-mentioned fault zones of Lomita, the City of Lomita can be affected seismically by southern California's two major faults or of having offset Holocene (recent) deposits. It must be within the San Andreas system capable of adversely affecting Lomita are the San Andreas, San Jacinto, Whittier-Elsinore, Norwalk, and Newport-Inglewood (including the Palos Verdes). Faults of concern in the Transverse Ranges system include the Sierra Madre, San Fernando, Santa Susana and the Raymond. The major faults associated with both systems should be considered active and capable of generating independent seismic events of the City of Lomita.

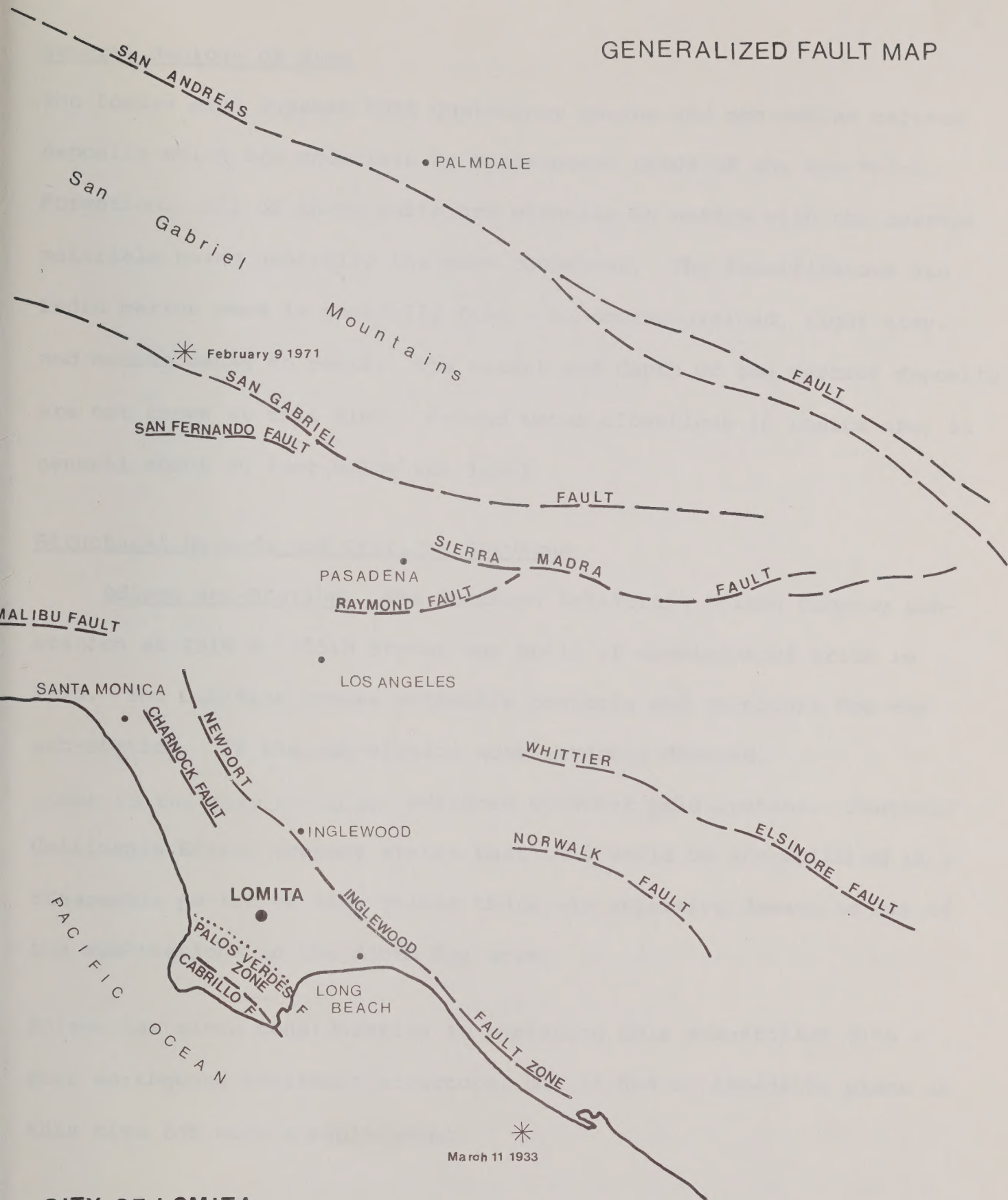
The Palos Verdes fault is not in addition to the above-mentioned fault zones of Lomita, the City of Lomita can be affected seismically by southern California's two major faults or of having offset Holocene (recent) deposits. It must be within the San Andreas system capable of adversely affecting Lomita are the San Andreas, San Jacinto, Whittier-Elsinore, Norwalk, and Newport-Inglewood (including the Palos Verdes). Faults of concern in the Transverse Ranges system include the Sierra Madre, San Fernando, Santa Susana and the Raymond. The major faults associated with both systems should be considered active and capable of generating independent seismic events of the City of Lomita.

considered capable of producing a seismic event as either an aftershock of a Newport-Inglewood event or independently.

The relative activity of the major faults is discussed in the Appendix. Two shocks of Richter magnitude greater than 6.0 have been recorded within 60 miles of Lomita. They were the March 11, 1933 Long Beach Earthquake ($M=6.3$) and the February 9, 1971 San Fernando ($M=6.4$). The number of previously recorded epicenters capable of affecting this area with accelerations approximating $0.15g$ (acceleration of gravity) are numerous. This and the proximity of the Newport-Inglewood zone places Lomita in a zone of seismic activity slightly higher than the average southern California location. However, the potential for accelerations greater than $0.15g$ is about the same as any area in the Los Angeles basin located on similar materials.

The relatively low level of seismicity associated with the Newport-Inglewood structural zone since the 1933 earthquake does not imply that there will not be other shocks similar to the 1933 earthquake. The quakes that have occurred serve as a reminder that this is a seismically hazardous area. Earthquakes and the damage they inflict on man's structures, deserve increased attention in planning for the future development of the Los Angeles Basin.

GENERALIZED FAULT MAP



CITY OF LOMITA SEISMIC SAFETY ELEMENT

APRIL 1 1974



1 inch = 10 miles

General Geology of Area

The Lomita area exposes both Quaternary marine and non-marine terrace deposits which are underlain by Pleistocene sands of the San Pedro Formation. All of these units are granular in nature with the terrace materials being generally the more competent. The fossiliferous San Pedro marine sand is generally fine - to coarse-grained, light gray, and medium dense to dense. The extent and depth of the terrace deposits are not known at this time. Ground water elevations in Lomita are, in general, about 50 feet below sea level.

Structural Hazards and Critical Services

Edison Sub-Station. The Southern California Edison Company sub-station at 2318 W. 255th Street was built of unreinforced brick in 1929. The building houses automatic controls and recorders for the sub-station. If the sub-station were severely damaged, power to the city would be switched to other grid systems. Southern California Edison Company states that this would be accomplished in a reasonable period of time unless there was extensive damage to all of the sub-stations in the South Bay area.

Edison has given consideration to replacing this sub-station with a more earthquake resistant structure, but it has no immediate plans at this time for such a replacement.

Oil Wells. According to the State Division of Oil and Gas, only one of fifteen oil wells drilled in Lomita is still in operation. This well is the Tavers No. 3 located near the north city boundary between Stanhurst Street and Walnut Street. The other fourteen oil wells have been abandoned and capped.

The oil well capping technique normally used is to fill the well with 50 feet of concrete above the production level, then mud to within 31 feet of the ground surface, and then place an additional 25 feet of concrete.

Of the fourteen capped oil wells, six were dry holes and eight were oil producers. None of them were natural gas producers.

Telephone Services. The Pacific Telephone Company maintains a switching facility at 25624 Walnut Street. The building was put into operation in 1953 and was recently remodeled. After analyzing the 1971 Sylmar earthquake which put a telephone switching station at that location completely out of operation, it was determined that additional bracing was needed on the various pieces of equipment to keep them from rocking into each other and being badly damaged.

This additional bracing has been installed at the local facility. The opinion of the Telephone Company is that the building and its equipment should withstand any potential shock without interruption of service.

The company has identified all facilities that would require emergency service - e.g. fire departments, hospitals, and other critical installations. If service should be interrupted, the Telephone Company has three emergency plans to put into effect depending on the severity of the damage. These plans range from connecting critical facility lines to those services which have not been damaged to placing manned microwave and radio trucks at strategic locations.

Water Systems in Lomita. The City of Lomita is served primarily by Los Angeles County Waterworks District No. 13 with the exception of one tract of 211 residences in the south portion of the city. (This section of the city is served by the California Water Services Company. The sources of water to the District consist of a four cubic foot/second connection to a Metropolitan Water District line in the northeast portion (south end of Cypress Street, 2275 W. 262nd Street located in Rolling Hills Estates) and a 7.5 cubic foot/second booster pumping station located at 26255 Appian Way. In emergency situations, water can be obtained if the lines are intact from the City of Torrance at 240th Street and Narbonne Avenue, and also from the MWD Palos Verdes Reservoir located at Palos Verdes Drive East and Palos Verdes Drive North.

The city is divided into four water zones. Zone No. 1 encompasses all of the city north of Pacific Coast Highway, with the exception of a

small segment in the west portion. Zone No. 2 consists of that section and the area generally bounded by Pacific Coast Highway south to the south city limits or to 263rd Street in the eastern half of the city. Zone No. 3 consists of 263rd Street south to the Rolling Ranchos tract. Zone No. 4 consists of one line one block long on Alta Vista Avenue between 262nd and 263rd Streets.

The Palos Verdes Fault Zone lies within 1000 feet of the one million gallon Cypress Street reservoir and also crosses the MWD line going up to the Palos Verdes Reservoir. If this fault were to undergo significant movement the line to the Palos Verdes Reservoir could be broken and the Cypress Street Reservoir also could be ruptured. Flooding from this facility would affect numerous single and multiple family residences in Lomita and probably affect traffic on Pacific Coast Highway (a state highway).

The California Water Services Company supplies water to the tract in the south portion of the city from the Metropolitan Water District's Palos Verdes Reservoir. The water for the tract is pumped to a higher location on the Palos Verdes Peninsula and then is allowed to gravity flow back into the tract. If the pumping station was put out of operation this area would eventually be without water. However, a rupture in the Palos Verdes Reservoir probably would not create any flooding danger for the City of Lomita due to the higher terrain north of the reservoir.

Schools in Lomita

Eshelman Elementary School, 25902 Eshelman Avenue, main building, 2 story concrete, built in 1924. It was cored and reinforced by the Los Angeles School District in 1960. A second 2 story building was built in the mid-1950's, construction is frame and stucco. An additional single story frame and stucco building (cafeteria) was constructed in the mid-1950's.

The capacity of the school is 900 students and a staff of 50. There was no damage from the 1971 San Fernando earthquake.

Lomita Elementary School, 2211 247th Street, the main building is 2 story concrete, built in the mid-1930's.

Enrollment is 1,072 with a staff of 50. There was no damage from the 1971 San Fernando earthquake.

Fleming Junior High School, 25425 Walnut Street, the main building is a 2 story concrete built in 1925. Enrollment is 2,030 students and a staff of 133. It was reinforced by the Los Angeles School District in 1960. There was no damage from the 1971 San Fernando earthquake.

Hillcrest Christian School, 26366 Hillcrest, (private church school), the main building is one story frame and stucco built in 1965. It has a capacity of 250; however, the current enrollment is 65. There was no damage from the 1971 San Fernando earthquake.

St. Margaret Mary School, 25429 Eshelman Avenue, (parochial), the school was constructed of reinforced concrete in 1950 and has a rating of class C. The capacity is 331. No damage was incurred from the 1971 San Fernando earthquake.

Churches in Lomita

Assembly of God, 25501 Oak Street, construction frame and stucco, built in 1964, capacity 500.

First Southern Baptist, 26366 Hillcrest, construction frame and stucco, built in 1958, capacity 200.

First Christian Assembly, 2043 242nd Street, construction frame and stucco, built in 1963, capacity 69.

Lomita Christian, 25512 Walnut Street, construction frame and stucco, built in 1963, capacity 164.

Lomita Missionary, 2043 Lomita Boulevard, construction frame and stucco, built 1970, second building steel quonset hut, built 1950, total capacity 300.

Narbonne Avenue Southern Baptist, 24730 Narbonne Avenue, construction cinder block, built in 1966, capacity of 650.

St. Margaret Mary, 25429 Eshelman Avenue, the parish hall was constructed of wood frame and cinder block in 1968, the church of wood frame and 6" gunite in 1953. The hall has a capacity of 628 and the church 790.

Wayside United Methodist, 25904 Cayuga, construction frame and stucco, some cinder block, built in 1941 and 1965, total capacity 480.

St. Marks Presbyterian, 24027 Pennsylvania Avenue, construction frame and stucco, original built in 1954, added to in 1965, total capacity 533.

The following churches could not be contacted for details.

Community Baptist, 2351 255th Street, construction frame and stucco, appears fairly new, medium size.

First Church of Christ Scientist, 25604 Narbonne Avenue, construction frame and stucco - appears 10 years old, small.

First Missionary Baptist, 2145 245th Street, construction frame and stucco, fairly old (15-20 years) large.

Lomita Foursquare, 2468 254th Street, frame and stucco, fairly old, medium size.

Group Quarters in Lomita

Hughes Guest House, 1870 261st Street, frame and stucco home, capacity of 5 persons.

Sister Cesina Convent, 25489 Eshelman Avenue, frame and stucco structure, 6 residents.

Peninsula Convalescent Hospital, 26309 Western Avenue, frame and stucco structure, capacity of 45 patients.

Golden Age Convalescent Hospital, 1955 Lomita Boulevard, frame and stucco structure, capacity of 71 patients.

Lomita Verde Convalescent Hospital, 2458 Lomita Boulevard, frame and stucco structure, capacity of 65 patients.

Sunny Oaks Guest House, 24845 Oak Street, frame and stucco structure, capacity of 7 residents.

First Missionary Hospital, 2145 28th Street, construction frame and
architectural details, 1915-20 years, large.

First Protestant, 2455 24th Street, frame and stone, fairly old,
architectural details, 1915-20 years, large.

Group Hospitals in Los Angeles

St. Vincent's Hospital, 1870 24th Street, frame and stone home, capacity
of 100 beds, 1915-20 years, large.

St. Francis Hospital, 25489 Sherman Avenue, frame and stone, 1915-20
years, large.

St. Joseph's Hospital, 18109 Western Avenue, frame and stone,
architectural details, 1915-20 years, large.

St. Luke's Hospital, 1955 Loma Vista Boulevard, frame and
stone, architectural details, 1915-20 years, large.

St. Mary's Hospital, 1818 Loma Vista Boulevard, frame and
stone, architectural details, 1915-20 years, large.

St. Michael's Hospital, 24845 Oak Street, frame and stone, 1915-20
years, large.

LAND USE AND CIRCULATION

Land Use

The land use pattern in Lomita is quite inconsistent. While some neighborhoods do present a unified residential pattern, quite often single-family homes are intermixed with apartment buildings and mobile home parks or are adjacent to industrial and commercial uses. Both single-family homes and apartment buildings front on major streets such as Narbonne Avenue and Lomita Boulevard. Lomita's commercial development is essentially of a strip nature along the major streets and highways.

Due to the fact that most of the city was originally subdivided along rural lines, various sections of the city contain lots which are relatively narrow and range to 400 feet in depth. The building pattern on many of these lots has been that of a single family home fronting on the street portion of the lot with a large vacant area behind. Some of these areas are still used for gardens or fruit trees - or even the keeping of some farm animals.

Over the years, one or two additional houses or multiple units were added at the rear of the original house on many of the deep lots, and the street access was provided by a long, narrow driveway. This arrangement usually does not meet current city codes and does not

conform to generally accepted standards of residential design. However, because many owners purchased these lots with the idea of "adding on" and because much of the city's vacant residential land is enclosed within the lots, acceptable and feasible site design techniques should be found so that proper development can occur. In some cases, especially near the western boundary of the city, removal of a few of the older houses would open up relatively large vacant residential sites. Developments on these sites would be required to meet modern design and safety standards.

Circulation Patterns

Many of Lomita's residential streets have a 50 foot or less right-of-way, which is below current traffic needs. The existing roadway widths do not permit two lanes of travel and parking on each side of the street. The standard of a 60 foot minimum street is desirable, but it has not proven practical to achieve.

In designing the street circulation plan for Lomita, a collector street pattern was used to improve cross town movement. This collector system was to relieve the grid pattern of local streets that are unable to accommodate increased traffic because of limited right-of-way widths.

The east-west collector streets are 250th Street, 255th Street and 262nd Street. The north-south collectors are Pennsylvania Avenue, Eshelman

Avenue, Walnut Street and Ebony Lane. Narbonne Avenue serves as a collector and secondary highway. The major highways are Pacific Coast Highway, Lomita Boulevard, Crenshaw Boulevard, Western Avenue and Palos Verdes Drive North.

The City of Lomita had been included within the study zones of the Route 1/107 Freeway. The freeway, commonly known as the Pacific Coast Freeway, included several study bands traversing Lomita. Most of them would have adversely affected this community. However, due to the strong efforts by the City Council, this threat to the stability of Lomita has been eliminated.

SEISMIC SAFETY ELEMENT RELATIONSHIPS

Relationship to the General Plan

This mandatory element of the Lomita General Plan reflects the statewide concern for seismic safety planning. Lomita's General Plan is almost ten years old, and it is being updated and revised to meet present State requirements. The Circulation Element and the Land Use Element are parts of the original document adopted in 1966. The City also has adopted the Housing Element and the Open Space-Conservation Element of the General Plan as required by State law.

Geographical and Physical Relationships

Most of Lomita is situated on a gently rolling plain overlaid with shallow deposits of alluvial material. This pattern is broken southerly of Pacific Coast Highway where the Palos Verdes Hills begin.

The portion of the city located on the south bay plain shares with other cities in the Los Angeles basin a susceptibility to damaging motion during a severe seismic occurrence.

The transition area between the plain and the hill areas of the city exhibits some potential for landslide and slippage during major seismic occurrences. However, this is minimized by well-established ground cover and building improvements.

The City-wide limitation of a two-story building height and the recent controls on residential density would act as a positive factor in reducing the percentage of casualties in the event of a major quake along the Newport-Inglewood system or great quake along the San Andreas system.

The relatively high number of Lomita residents who live in structures built within the past 25 years may be considered an asset in seismic safety planning. This factor is coupled with a seemingly high level of replacement activity for older construction.

The impact of major disturbances along the San Andreas or Inglewood-Newport fault systems could be significant even if structural damage was limited. This is due to the fact that most of the city's major supply lines for electrical power, natural gas, and transportation (highways and freeways) cross one or both of these active fault systems.

Lomita's local street and water systems were built to meet low density needs, but previous zoning provided for relatively high residential density. The growing water distribution problem was highlighted in 1972 when the Fire Department reported that 58 percent of the water mains in portions of the City which permitted multiple residential developments did not meet minimum fire flow requirements. The City subsequently moved forcefully in rectifying this situation by enacting

zone changes and density limitations. Also, Lomita is in the process of establishing a joint powers arrangement with Los Angeles County Water District No. 13 to provide Federal Revenue Sharing funds to improve the water distribution system within the city.

Social Relationships

The 1970 Census shows that about 15 percent of Lomita residents are under 10 years of age or over 70 years of age. This segment of the population can be considered especially dependent in case of a major disaster. Emergency housing facilities, and to a lesser extent medical facilities, are a priority seismic safety planning problem for this segment of our population.

An inventory of available public and semi-public facilities suitable and available for temporary housing during time of disaster represents a positive action the city can undertake.

The prime east-west and north-south traffic arteries which cross Lomita can be expected to carry traffic from persons displaced from impact areas closer to major quake epicenters. However, this does not appear to present a significant planning problem.

Emergency housing could be made available to persons from areas to the north and east of Lomita to whom the possibility of being made homeless due to a major earthquake is much greater due to their locations nearer to active earthquake fault areas.

Economic Relationships

The City has made a commitment to lower potential residential density which has largely been implemented. The elimination of high rise zoning and the reduction of the intensity of use of property have been accomplished.

Requirements for geologic review and report and, if necessary, remedial action are economic burdens which are desirable and widely accepted in both industry and government.

Building controls and land use adjustments are acceptable and desirable limitations on the use of land. Continued positive action in these areas and an intensified geologic review of proposed land use changes, along with the continued replacement of dated structures, would reduce the percentage of lives lost within the City should a major quake strike the area.

Environmental Impact Report Procedures

It is appropriate and desirable that the City require that a comprehensive environmental impact report be prepared on all significant projects that deal with new buildings or zone changes that provide for intensification of land use. A development's ability to withstand potential natural disaster should play an important part in the findings in such a report.

Interagency Cooperation

The governmental agencies that serve Lomita also serve a number of its neighboring jurisdictions through contractual arrangements with the County of Los Angeles, and the city further benefits from mutual aid arrangements with other jurisdictions. The County Departments of Sheriff and Forester and Fire Warden represent two of the largest and best equipped such departments in the country. The ability of these departments to draw on equipment and personnel from other areas to meet emergency situations is a great advantage to the City and its neighbors.

the governmental agencies that have been a member of the
neighboring jurisdictions through financial arrangements with the
city of Los Angeles, and the city further benefits from mutual aid
arrangements with other jurisdictions. The County Department of
Health and Forester and also within represent two of the largest and
best equipped such departments in the country. The ability of these
departments to draw on equipment and personnel from other areas in
an emergency situation is a great advantage to the City and its
neighbors.

IMPLEMENTATION AND REVIEW

Revision of General Plan and Zoning Changes

This new element of the General Plan is only one of a number of new elements now required by the laws of the State of California. Fortunately, Lomita had been foresighted in the earlier years after its incorporation to have had prepared and adopted a comprehensive general plan. This plan, adopted in 1966, contained a Land Use Element and a Circulation Element. On February 20, 1973, a Housing Element was adopted, and on June 18, 1973, the Open Space-Conservation Element was adopted. The remaining mandatory elements of the General Plan - Noise, Scenic Highways and Safety - must be adopted by September 20, 1974.

During the past two years, the City Council has taken numerous actions to update the General Plan and to make the zoning of the City consistent with the General Plan. This has meant that substantial portions of the City's zoning have been changed to provide a lower density of population. Additionally, the City has acquired several new park sites and they are being developed at the present time. It is likely that four small parks will actually be open to the public before the end of the calendar year 1974.

Renewal Plans

The City of Lomita has no specific renewal plans (as such) at the present time. However, the City does have a continuing program for the upgrading and improvement of the streets of Lomita. This includes the resurfacing and widening of streets and the building of curbs, gutters and sidewalks where needed. The planting and adequate maintenance of street trees is an integral part of City policy. Also, it is anticipated that Lomita will have a new Civic Center and a new Sheriff's Station within the next two years. Both of these projects are now on the drawing boards, and are expected to be in actual construction within the next few months.

Building Inspection Program

A continuing building inspection program has been followed throughout the years of Lomita's existence. Due to the nature of the improvements within the City, it has not been necessary to follow an extensive building inspection program with particular reference to seismic safety. However, in the future, major construction or developments should be required to conform to seismic safety in accordance with contemporary standards. The owners of older buildings, particularly any masonry buildings constructed prior to 1933, should be made aware of current building requirements. It has been found that pre-1933 buildings used lime mortar for joints, poor quality bricks, inadequate structural ties

connecting roofs and walls, and no reinforcing steel in the walls. Any high risk structure in Lomita should be located and identified. If it is economically feasible to do so, such a structure should be strengthened and modernized. In some cases, it may be more appropriate to reduce the load level or occupancy of the structure. As a last resort, any building which cannot be rehabilitated and is literally unsafe should be demolished.

Contingency Plans for Major Disasters and Emergencies

In cooperation with Civil Defense Area G of Region I (Los Angeles County) of the California Office of Emergency Services, the City of Lomita has prepared an Emergency Operation Plan (EOP). This plan provides for preparing, mobilizing and employing public and private resources to meet essential needs in serious emergencies. This plan can be placed in effect when a state of war emergency exists in the State of California, when a state of emergency affecting Lomita is declared by the Governor, or in case of local emergency by action of the City Government.

The City of Lomita also has a Mutual Aid and Joint Powers Agreement with the twelve other cities located within operational Area G of Civil Defense Region I of California. This agreement provides that it is necessary and desirable that the resources, personnel, equipment and

facilities of any one party to the agreement be made available to any other party to prevent, combat, or eliminate a probable imminent, or actual threat to life or property resulting from a local peril, local emergency, local disaster, or civil disturbance, in the absence of a duly proclaimed "state of extreme emergency" or "state of disaster", and to render mutual and supplementary police protection one to the other as the need may arise.

Seismic and Emergency Information Programs

Study and experience have shown that the public generally does not know what to do before, during, or after a major earthquake. Due to the unpredictability of earthquakes and the potential violence and destruction in their wake, some individuals fail to prepare properly, and therefore react irrationally. Lomita has a responsibility to provide, through the news media and other educational services, advice and information to the public on how to prepare to meet this contingency and how to recover after an earthquake has occurred.

The public should be made aware of the relative seismic safety hazards of Lomita and its geographical area. Consequently, the city should develop and implement an emergency information and education program to provide the public with timely instructions that will enable the residents to prepare for and safely respond to the effects of a major

earthquake or other type of disaster or emergency. This should include information about the nature of earthquakes and why Southern California is subject to seismic occurrences.

The local schools, churches and civic organizations should be encouraged and aided to the extent practicable, to provide disaster training for school children and others. This should include information and advice on how to protect themselves, their families, and their homes during and after a major earthquake or other emergency.

Building Code Update

The City of Lomita operates under the Los Angeles County Building Code which has been adopted by Lomita by reference. Prior to adoption by the Board of Supervisors, the Building Code and its amendments are submitted for thorough review by the construction industry and various professional organizations. Also, many of the changes are reviewed and adopted by the International Conference of Building Officials in updating the basic Uniform Building Code.

In cooperation with the County and the ICBO, steps should be taken to provide the necessary building regulations to insure the stability of major new buildings in case of significant seismic events. Conversely, the City should be aware of the changes made by the ICBO in the Uniform Building Code to increase the seismic safety of various kinds of structures, and they should be adopted for appropriate use in Lomita.

CONCLUSIONS AND RECOMMENDATIONS

Based upon the data developed during this study for the Seismic Safety Element of the General Plan of the City of Lomita, the following comments, conclusions and recommendations are submitted for consideration and action:

1. No earthquake faults are known to directly underlie the City of Lomita. Investigations of the Palos Verdes Fault Zone indicate that it has not moved tectonically since the late Lower Pleistocene era, and it is not considered active. However, some branches may not have been located and geologic surveillance should continue as areas near the zone are more fully developed.
2. Lomita generally is underlain by about 30 feet of Quaternary terrace materials overlying the Pleistocene San Pedro sand, and would not appear to be subject to liquefaction.
3. The seismicity of Lomita for accelerations over 0.15g, compares with most sites overlying similar deposits in the Los Angeles basin. For horizontal accelerations

less than 0.15g, Lomita should be considered slightly more susceptible than a similar average site in the Los Angeles basin.

4. Lomita is not subject to the effects of tsunamis or seiches due to its elevation and distances from the ocean or other large bodies of water.
5. The Newport-Inglewood Fault Zone lies to the east and north of the city, and it should be considered potentially destructive. The same is true of the more distant, but historically quite active, San Andreas Fault System.
6. Any earthquakes which might originate along the Newport-Inglewood Fault Zone might generate ground shaking of relatively high intensity and frequency but of short to moderate duration. However, an earthquake along the San Andreas Fault, probably would be of moderate intensity, low frequency, and relatively long duration.
7. Minimal hazards from earthquake generated landslides or settlements would be limited to the areas south

of Pacific Coast Highway along the hills. Such hazards can be further minimized by the effective utilization of engineering geology and soil engineering, the enforcement of grading codes, and proper design and grading of hillside developments in this area of Lomita.

8. The upgrading of building and safety codes for new construction from a seismic safety standpoint should be aimed at lessening loss of life or serious injury. Any increased protection above this level should be at the option of the owner of the property. However, property owners should be encouraged to take the steps necessary to protect their properties against the economic risks of seismic hazards.
9. Pre-1933 buildings in Southern California constitute the most serious threat to public safety because of the probability of their collapse during strong earthquakes in the future. Such buildings in Lomita should be brought up to modern standards of seismic resistance, or eventually they should be demolished. Because of the economic and social consequences of requiring major repair or demolition, a phased program

of Pacific Coast Highway along the hills. Such hazards can be further minimized by the effective utilization of engineering geology and soil engineering, the enforcement of grading codes, and proper design and grading of hillside developments in this area of Los Angeles.

8. The upgrading of building and safety codes for new construction from a seismic safety standpoint should be aimed at insuring loss of life or serious injury. Any increased protection above this level should be at the option of the owner of the property. However, property owners should be encouraged to take the steps necessary to protect their properties against the economic risks of seismic hazards.

9. Pre-1933 buildings in Southern California constitute the most serious threat to public safety because of the probability of their collapse during strong earthquakes in the future. Such buildings in Los Angeles should be brought up to modern standards of seismic resistance, or eventually they should be demolished. Because of the economic and social consequences of resulting major repair or demolition, a phased program

should be started with those buildings that present the greatest hazard - relative to use, location and nature of construction - receiving the first attention.

10. Structures and facilities which are particularly important in post-disaster operations, such as hospitals, emergency power installations, emergency operating centers, public safety facilities and essential elements of key communications systems, should be designed and constructed to withstand strong earthquake shaking and to continue to function. Existing critical facilities not designed to be earthquake resistant should be eliminated or rehabilitated in an orderly manner consistent with acceptable policy risk levels.

11. Although most modern school buildings performed very well during the San Fernando earthquake, some potentially hazardous damage was sustained by a few of them in that area. Such damage should be studied by regulatory agencies, and the code requirements for earthquake resistance of schools should be revised to eliminate these hazards.

12. Most typical, modern, one-story, wood-frame houses perform well during earthquake ground shaking in that no severe hazards are created nor are major economic losses widespread in such structures. However, some modern, non-typical houses have been severely damaged by earth shaking. Studies should be made of the applicable building code specifications to work out practical revisions so as to improve the earthquake resistance of such non-typical houses. Also, earthquake insurance should be available to the homeowner by its inclusion in extended-coverage riders on "standard homeowners insurance" and on "standard fire" policies.

13. Utilities and pipelines serving or within Lomita should consider the effects of significant seismic events in the planning, design, construction and operations of their installations. To the extent practicable, they should provide spares or redundancies in separated locations, and they should develop repair and recovery ability for emergencies including standby capability. In general, the features of the various systems which are the most

vulnerable to seismic disturbances should be identified, and steps should be taken to minimize potential adverse effects. For example, valves should be installed at strategic locations for shutoff and isolation of a section of a system. Interconnections of systems for safety are desirable even though they may be limited in capacity.

14. Public safety and welfare depend greatly on the functioning of public utility systems, such as water supply, sewers, gas, electricity, communications and transportation. Consequently, continuing attention should be given to insure that these facilities will not be seriously disrupted during an earthquake. Public utilities are, in general, such complicated systems that special studies should be made on how adequate earthquake resistance can best be achieved at an economical cost. The State of California probably should take the lead in initiating and sponsoring such research.

15. There are no major highway structures, overpasses, bridges, or tunnels within the City of Lomita which

would be vulnerable to landslides, liquefaction or other geologic hazards. Oil and natural gas pipelines and other such installations in or adjacent to Lomita are believed to be only of nominal hazard to this City.

16. Adequate fire protection should be an integral part of the planning for seismic safety. This includes provisions for an adequate water supply, both from the standpoint of an effective distribution system and a standby source of water on an emergency basis. Also, zoning practices should insure that future developments adequately provide for the manipulation and deployment of firefighting equipment, particularly in the residential areas of the City.

SELECTED BIBLIOGRAPHY

AND

APPENDICES

Selected Bibliography

Appendix A - Definitions of Terms

Appendix B - Relative Activity of Major Faults

SELECTED BIBLIOGRAPHY

- California Council on Intergovernmental Relations, General Plan Guidelines, September 1973.
- California Division of Mines and Geology, "Earthquakes Along the Newport-Inglewood Structural Zone", California Geology, March 1973.
- California Division of Mines and Geology, Geologic Map of California, Long Beach Sht., 1971.
- California Division of Mines and Geology, Urban Geology - Master Plan for California, Bulletin 198, 1973.
- Central and West Basin Water Replenishment District, Annual Survey Report on Ground Water Replenishment, 1973.
- City of Burbank, Interim Seismic Safety Element, 1974.
- City of Burbank, Safety Element, 1974.
- City of Inglewood, Preliminary Seismic Safety Element; Inglewood General Plan, 1974.
- City of Los Angeles, Department of City Planning, Preliminary Seismic Safety Plan, April 1974.
- City of Torrance, Seismic Safety Element; Comprehensive General Plan, April 1973.
- Converse, Davis and Associates, Geologic Evaluation of Faulting and Seismicity, Proposed Lomita Administrative Center, City of Lomita, California, May 1972.
- Converse, Davis and Associates, Geologic Evaluation of Faulting and Seismicity - Proposed Lomita Sheriff's Substation, City of Lomita, California, September 1972.
- County of Los Angeles, Chief Administrative Officer, Reports of the Earthquake Task Forces, March 1972.

[illegible]

County of Los Angeles, Department of County Engineer, Earthquake Task Force-Water Utilities Committee-Design Standards Subcommittee, August 1973.

County of Los Angeles Earthquake Commission, Report on San Fernando Earthquake, November 1971.

Governor's Earthquake Council, First Report of the Governor's Earthquake Council, November 1972.

State of California, Joint Committee on Seismic Safety, Meeting the Earthquake Challenge, January 1974.

State of California Office of Emergency Services, Emergency Assistance Guide to State and Federal Resources, January 1974.

State of California Resources Agency, Watermaster Service in the West Coast Basin, Los Angeles County, December 1973.

Tri-Cities Seismic Safety and Environmental Resources Study, El Cerrito, Richmond, and San Pablo, The Seismic Safety Study for the General Plan, September 1973.

DEFINITIONS OF TERMS

Accelerograph

An instrument for measuring accelerations or for detecting and measuring vibrations.

Aftershock

Aftershocks are a part of the release of accumulated elastic strain. When a significant earthquake occurs, it not only relieves the pressure along its particular section of fault but also changes the stress patterns for miles around. These changes, in turn, create adjustments of their own.

California Emergency Services Act

The California Emergency Services Act, Chapter 7 of Division 1 of Title 2 of the Government Code, is that portion of the State Code that provides the legal basis for the preparation of emergency plans and the conduct of emergency operations by the State of California and its political subdivisions.

Emergency Operating Center (EOC)

An emergency operating center is a facility designed and equipped to provide a site for local government executives and key officials to direct and control emergency operations. When constructed to Federal criteria, it provides protection against fallout radiation (100 protection factor) and includes a communications center, emergency power, fuel, food and water for a fourteen-day period.

Emergency Operations

Emergency operations refer to those measures and actions taken by local governments and their departments and agencies to minimize loss of life and property and to mitigate hardship resulting from disaster and to expedite recovery.

Epicenter

The part of the earth's surface directly above the point where the fault slip began.

Fault

A fracture of the earth's crust accompanied by a displacement of one side of the fracture with respect to the other in a direction parallel to the fracture.

Active Fault

A fault that has moved in recent geologic time and which is likely to move again in the relatively near future. (For geologic purposes, there are no precise limits to recency of movement or probable future movement that define an "active fault". Definitions for planning purposes extend on the order of 10,000 years or more back and 100 years or more forward. The exact time limits for planning purposes are usually defined in relation to contemplated uses and structures.)

Inactive Fault

A fault which shows no evidence of movement in recent geologic time and no evidence of potential movement in the relatively near future.

Field Act

A statute (Education Code, Sections 15451-15465), enacted following the Long Beach earthquake of 1933, that gave the State Division of Architecture authority and responsibility for approving design and supervising construction of public schools and establishing severe penalties for violations.

Foreshock

Minor movements along faults that sometimes precede and may even provide part of the triggering device for a main earthquake shock. They can occur weeks or months in advance, and their foci or hypocenters may be somewhat removed from that of the main movement.

Ground Deformation

Visible manifestation of earth movement along a fault, or earth cracking. Such movement may have been vertical or horizontal, or both.

Modified Mercalli Scale

A system that describes the effects (intensity) of an earthquake at specified points in terms of a series of levels ranging from I to XII. These intensities tend to be highest near the epicenter of the earthquake, decreasing with increasing distance from a central area; but often this is much modified by the nature of the ground.

Parapet Law

Refers to ordinances enacted by the County of Los Angeles, the City of Los Angeles and other jurisdictions that require building owners to remove parapets or appendages on buildings that constitute possible hazards.

RACES

The Radio Amateur Civic Emergency Services are volunteer organizations comprised of amateur radio operators who are duly enrolled in the emergency organizations of local governments.

Richter Scale

The Richter Magnitude Scale measures the magnitude of an earthquake. Earthquake magnitude numbers are used to compare different earthquakes independently of the locations of their epicenters or points of observation. They are calculated from measurements of seismograph records.

Riley Act

Health and Safety Code, Division 13, Part 3, Chapter 2, (Sections 19100-19170, which was enacted in 1933 following the Long Beach earthquake. The act established minimum State standards for construction and exempted farm buildings and dwellings occupied by not more than two families outside the limits of incorporated areas.

Scarp

A line of cliffs produced by faulting or erosion.

Seiches

Earthquake-induced waves in lakes or ponds.

Seismic Sea Waves (Tsunami)

Ocean waves, created by submarine earthquakes, that travel great distances at high speeds (average 450 mph) and have a high destructive potential depending on a number of factors such as shoreline configuration and depth of water. They are commonly referred to as tidal waves.

Seismograph

An instrument that writes a continuous record of the successive earth waves generated by an earthquake.

Soil Liquefaction

Change of water saturated cohesionless soil to liquid, usually from intense ground shaking; soil loses all strength.

Strong Shaking

That degree of shaking produced by the earth waves that are generated by an earthquake and radiate out from the hypocenter which is sufficient to cause substantial damage to structures of any size.

Tectonic

Of or relating to the deformation of the earth's crust; the forces involved in or producing such deformation, and the resulting forms. Movement may be rapid resulting in an earthquake, or slow (tectonic creep).

Uniform Building Code

The Uniform Building Code of the International Conference of Building Officials, which was written and adopted initially by the members of the conference in 1926 and as repeatedly amended. Though "uniform" in appearance, it recognizes special requirements of individual areas and so provides.

RELATIVE ACTIVITY OF MAJOR FAULTS

San Andreas Fault System

San Andreas Fault - This fault is the longest and one of the most active faults in California. Its historic record shows evidence of large seismic events, the offset of stream courses, and ruptures of the ground surface. The largest associated historic seismic event affecting Southern California was the Magnitude 8.0+ (Richter Scale) earthquake near Fort Tejon in the Tehachapi Mountains in 1857. The ground ruptured over a length of greater than 200 miles during this event. The fault section located between Palmdale and the Salton Sea is capable of generating an earthquake of at least this magnitude. The closest approach of the San Andreas fault to Lomita is about 50 miles.

San Jacinto Fault - This fault is considered to be the most active fault in Southern California. It originates on the north side of the San Gabriel Mountains south of Pearblossom and extends south into Mexico. The fault separates into many segments as it enters the Salton Sea trough area. Several Magnitude 6.0+ shocks have been recorded on the San Jacinto fault. Ground breaks have been associated with at

least two of these earthquakes (Borrego Springs, 1968 ($M = 6.5$), and Imperial Valley, 1940 ($M = 7.1$)). This fault should be considered capable of a 7.0+ magnitude earthquake shock. The closest approach of this fault to Lomita is about 48 miles.

Newport-Inglewood Fault Zone - This zone of deformation consists of several en-echelon folds and faults that extend from near Laguna Beach north to the Santa Monica Mountains, a distance of about 45 miles. This zone is known to be seismically active, but there is no record of historic ground rupture associated with the faults in this zone. There is, however, evidence of about seven inches of subsurface displacements in oil wells during two separate shocks of Magnitudes 4.9 (1941) and 4.5 (1944). The largest recorded event is a Magnitude 6.3 in March, 1933. This is believed to be near the maximum probable magnitude event that this zone is capable of generating. The Newport-Inglewood zone approaches to within 6.5 miles of Lomita.

Palos Verdes Fault Zone - This zone trends approximately northwest to southeast and is about 9.5 miles long. The closest approach to Lomita is less than one mile for the buried trace of the fault. No seismic events (greater than Richter Magnitude 4.0) have been definitely associated with the fault and it does not exhibit any evidence of surface rupture.

The location of the Palos Verdes fault is based upon both oil well data and an inference that the uplift of the Palos Verdes Hills must have taken place along such a structure near the bedrock/alluvium boundary. There is also a significant Bouguer gravity anomaly that parallels this trend. The Palos Verdes fault should be considered within the Newport-Inglewood zone of deformation and potentially capable of yielding a smaller aftershock sympathetic with a larger earthquake on the Newport-Inglewood. The probability of associated ground displacement on the fault is essentially nil and its consideration is not deemed necessary in design considerations.

Whittier-Elsinore Fault - The northernmost extension of the Whittier-Elsinore fault lies about 22.5 miles east of Lomita. This northwest trending fault system continues southeastward from the Alhambra area (Workman Hill extension) through the Santa Ana Mountains to the Mexican border. The central portion of this zone is moderately active, having produced numerous Magnitude 4.0+ earthquakes and a few Magnitude 5.0+ shocks. Seismicity attributable to the northern section of the Whittier fault has been low. There is recent unpublished evidence that indicates displacement of Quaternary deposits (7,000 to 11,000 years old) associated with this fault system. There is no evidence, however, of recent ground rupture. The northern section should be considered capable of producing a Magnitude 6.0 shock.

Norwalk Fault - This fault is approximately 16 miles long, roughly northwest trending, and its closest approach to Lomita is about seven miles. The fault has an arcuate trace between Buena Park and Tustin. Microseismic activity on the fault is relatively high and a Magnitude 4.7 earthquake on July 8, 1929, caused significant damage in Whittier and Norwalk. Although no recent ground breaks are known to exist, unpublished data indicate about 40 feet of displacement of Quaternary deposits on a suspected southward extension of the Norwalk fault. Richter (1968) believes that the fault may be capable of generating a Magnitude 6.25 earthquake.

Transverse Range Fault System

Sierra Madre Fault - This fault is a frontal fault along the southern foothills of the San Gabriel Mountains stretching from Sunland east to Pomona, a distance of about 35 miles. Here the Sierra Madre fault may merge with the Cucamonga fault and continue eastward. Although no historic ground rupture or associated major seismicity is known, there is abundant evidence of late Quaternary thrust faulting at many points along the Sierra Madre fault. There are a few 4.0 to 4.9 earthquake shocks associated with the east end of the fault zone, but they have not been directly associated with the Sierra Madre (Cucamonga) fault.

Normal fault - This fault is approximately 11 miles long, roughly
northwest trending, and its closest approach to the coast is about
miles. The fault has an average strike between 300° and 330°.
Microseismic activity on the fault is relatively high and a magnitude
4.7 earthquake on July 8, 1959, caused a significant change in seismic
and seismicity. Although the exact ground motion was known to exist,
unpublished data showed about 10 feet of displacement of the
deposits on a suspected southeast extension of the Normal fault.
Richter (1958) believes that the fault may be capable of generating a
Magnitude 8.25 earthquake.

TRANSVERSE RANGE FAULT SYSTEM

Slater Range Fault - This fault is a normal fault along the southern
foothills of the San Gabriel Mountains extending from San Gabriel east to
Pomona, a distance of about 15 miles. From the Sierra Madre fault, it
merges with the Cucamonga fault and continues eastward. Although no
historic ground rupture or associated major seismicity is known, there
is abundant evidence of late Pleistocene thrust faulting at many points
along the Slater Range fault. There are also 4.9 earthquakes
associated with the east end of the San Gabriel fault. They have
not been directly associated with the Slater Range (Transverse) fault.

This fault should be considered capable of producing an earthquake with magnitude of at least equal to that of the February 9, 1971 San Fernando Earthquake ($M = 6.4$) The fault has a closest approach to Lomita of about 30 miles.

San Fernando Fault - The fault segments that were demonstrably involved in the activities of the February 9, 1971 San Fernando Earthquake (Magnitude 6.4) are for the most part east-west trending thrust and left-lateral faults. The ground surface ruptures occurred on little known preexisting faults in an area of low seismicity and previously unknown ground displacements. The zone of displacements, the maximum of which was approximately three feet, has a length of about nine miles. These faults lie approximately 35 miles north of Lomita.

77 02069

U.C. BERKELEY LIBRARIES



C123320293